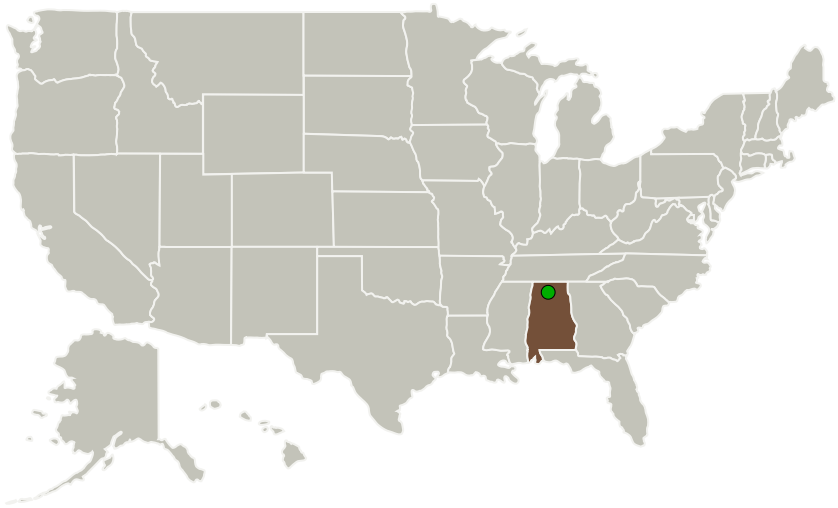
# Multipulse Solid Rocket Motors for MAV, Phase I

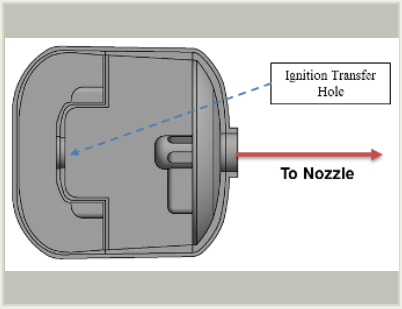
Completed Technology Project (2016 - 2016)

## Project Introduction

The Mars Ascent Vehicle is undergoing extensive vehicle trades to fine tune the optimal performance for a two-stage rocket motor solution to bring a payload from the Mars surface to orbit. The key is this vehicle must provide a terminal velocity of approximately 4 km/s, remain small in length and weight, and ensure the payload does not exceed 4 g's of acceleration during vehicle ascent. Based on initial vehicle architecture optimization analysis completed by engineers at Arctic Slope Technical Services (ASTS), the acceleration limit places a significant impact on the grain profiles used on both the first and second stage rocket motors. Therefore, the use of a dual pulse rocket motor grain design enables the use of two subsequent pulses that are ignited so as to mimic a single grain along the optimal thrust profile. This solution burns down the risks associated with an end burning grain design. The dual pulse grain design leverages finocyl designs that offers significant grain stress relief because of the fins. Also this approach offers the ability for a smaller and lighter nozzle because of the shortened burn time. Moreover, this will provide significant opportunity for the motors to get smaller in length by being able to be packaged more efficiently. This reduction in motor length will enable for a more stable vehicle in flight as well as enable the vehicle to carry either a larger volume payload or reduce the impacts on the transportation vehicle as it takes the MAV to the Mars surface.

## Primary U.S. Work Locations and Key Partners



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Completed Technology Project (2016 - 2016)

| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ASRC Federal Astronautics, LLC | Lead Organization | Industry | Huntsville, Alabama |
| Marshall Space Flight Center(MSFC) | Supporting Organization | NASA Center | Huntsville, Alabama |

| Primary U.S. Work Locations |
|---|
| Alabama |

## Project Transitions

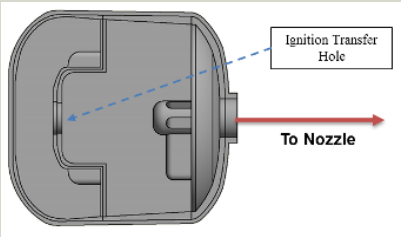
**June 2016:** Project Start

**December 2016:** Closed out

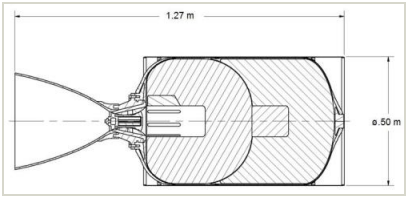
**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/139605)*

## Images




**Briefing Chart Image**
Multipulse Solid Rocket Motors for MAV, Phase I
*(https://techport.nasa.gov/image/133238)*




**Final Summary Chart Image**
Multipulse Solid Rocket Motors for MAV, Phase I Project Image
*(https://techport.nasa.gov/image/127415)*

## Organizational Responsibility

**Responsible Mission Directorate:**
Space Technology Mission Directorate (STMD)

**Lead Organization:**
ASRC Federal Astronautics, LLC

**Responsible Program:**
Small Business Innovation Research/Small Business Tech Transfer

## Project Management

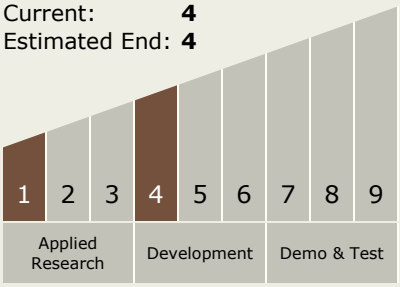
**Program Director:**
Jason L Kessler

**Program Manager:**
Carlos Torrez

**Principal Investigator:**
Bradford Luff

## Technology Maturity (TRL)

Start: **1**
Current: **4**
Estimated End: **4**



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## Technology Areas

**Primary:**

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System